DOCUMENT RESUME

ED 092 694 CE 001 423

TITLE	Overhaul, Inspection and Repair of Reciprocating Engines 1 (Course Outline), Aviation Mechanics (Power Plant): 9055.01.
INSTITUTION	Dade County Public Schools, Miami, Fla.
PUB DATE	71
NOTE	28p.; An Authorized Course of Instruction for the Quinmester Program
EDRS PRICE	MF-$0.75 HC-$1.85 PLUS POSTAGE
DESCRIPTORS	Audiovisual Aids; *Aviation Mechanics; Aviation Technology; Behavioral Objectives; *Curriculum Guides; *High School Curriculum; Job Skills; Secondary Grades; *Technical Education; Vocational Education
IDENTIFIERS	*Quinmester Program

ABSTRACT

The course outline has been prepared as a guide to help the trainee acquire the knowledge and skills associated with the overhaul, inspection, and repair of reciprocating engines. This course is the first of two and must be completed first. Successful completion of these courses and others will provide the trainee with the knowledge and skills required to pass the Powerplant Theory and Maintenance section of the Federal Aviation Administration examination for the powerplant mechanic license. The course is composed of one block of several units requiring one quinmester of 135 hours. Five pages of course outline are followed by 10 pages of specific behavioral objectives; a posttest is appended. The bibliography of references includes Federal Aviation Agency publications and titles of audiovisual aids, which are heavily emphasized in the course. No worksheets are included. (Author/AJ)

ED 092694

AUTHORIZED COURSE OF INSTRUCTION FOR THE QUINMESTER PROGRAM

U S DEPARTMENT OF HEALTH
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

Course Outline

AVIATION MECHANICS (Power Plant)
(Overhaul, Inspection and Repair of Reciprocating Engines)

Department 48 - Course 9055.01

OE001423

DADE COUNTY PUBLIC SCHOOLS
DIVISION OF INSTRUCTION • 1971

ED 092694

D A D E C O U N T Y P U B L I C S C H O O L S

1 4 1 0 N O R T H E A S T S E C O N D A V E N U E

M I A M I, F L O R I D A 33132

Course Outline

AVIATION MECHANICS (Power Plant)
(Overhaul, Inspection and Repair of Reciprocating Engines I)

Department 48 - Course 9055.01

the division of

VOCATIONAL, TECHNICAL AND ADULT EDUCATION

DADE COUNTY SCHOOL BOARD

Mr. William Lehman, Chairman
Mr. G. Holmes Braddock, Vice-Chairman
Mrs. Ethel Beckham
Mrs. Crutcher Harrison
Mrs. Anna Brenner Meyers
Dr. Ben Sheppard
Mr. William H. Turner

Dr. E. L. Whigham, Superintendent of Schools
Dade County Public Schools
Miami, Florida 33132

Published by the Dade County School Board

Course Description

9055	48	9055.01	Overhaul, Inspection and Repair of Reciprocating Engines I
State Category Number	County Dept. Number	County Course Number	Course Title

A basic course in the theory of reciprocating aircraft engine design, construction and operation. Special emphasis is placed on inspection, repair, and overhaul requirements and practices.

Indicator of Success: Successful completion of courses 9073.01, 9073.02, 9073.03 and 9073.04.

PREFACE

The course outline that follows has been prepared as a guide to help the trainee acquire the knowledge and become proficient in the skills associated with the overhaul, inspection and repair of reciprocating engines. This course is the first of two courses on the overhaul, inspection and repair of reciprocating engines and must be completed first. Successful completion of this course plus courses 9055.02, 9055.03 and 9055.04 will provide the trainee with the skills and knowledge required to pass the Powerplant Theory and Maintenance section of the Federal Aviation Administration examination for the Powerplant Mechanic's License. Courses 9073.01, 9073.02, 9073.03 and 9073.04 are prerequisites for this course. This course is composed of one block of several units requiring one quinmester of 135 hours.

Great emphasis will be placed on the use of audio visual aids and instruction sheets of various types. A list of behavioral objectives the trainee will be required to perform is included. Following each unit title will be found in parentheses several letters and numbers designating the time spent in terms of theory and shop work. EIT indicates estimated instructional time, T indicates time spent in theory or classroom work, and L/S indicates time spent in laboratory or shop work.

The level 1 following a unit indicates the student must have knowledge of general principles but no practical application nor manipulative skill. Instruction is given by lecture, demonstration, and discussion.

The level 2 following a unit indicates the student must have knowledge of general principles and limited practical application, and sufficient manipulative skill to perform basic operations. Instruction is given by lecture, demonstration, discussion, and limited practical application.

The level 3 following a unit indicates the student must have knowledge of general principles and performance of a high degree of practical application, and sufficient manipulative skill to accomplish return to service. Instruction is given by lecture, demonstration, discussion, and a high degree of practical application.

This outline was developed through the cooperative efforts of the instructional and supervisory personnel, the Quinmester Advisory Committee, and the Vocational Teacher Education Service, and has been approved by the Dade County Vocational Curriculum Committee.

TABLE OF CONTENTS
with Suggested Hourly Breakdown

	Page
PREFACE	1
GOALS	iv
BLOCK	
I. RECIPROCATING ENGINES (135 hours)	
Reciprocating Engine Theory	1
Overhaul Reciprocating Engines	2
II. QUINMESTER POST TEST	
BEHAVIORAL OBJECTIVES	6
BIBLIOGRAPHY	11
APPENDIX: QUINMESTER POST TEST SAMPLE	15

GOALS

The aviation maintenance technician must be able to demonstrate:

1. Knowledge of engine operation and construction techniques.

2. The various procedures necessary to overhaul, inspect, and repair reciprocating engines.

3. Knowledge of methods of engine inspection.

4. The ability to locate information in manufacturer's overhaul and maintenance manuals and utilize same.

Course Outline

AVIATION MECHANICS (Power Plant)
(Overhaul, Inspection and Repair of Reciprocating Engines I)

Department 48 - Course 9055.01

I. RECIPROCATING ENGINES (135 hours)

A. Reciprocating Engine Theory
(Level - 3) (EIT-30 hrs) (T-21 hrs) (L/S-9 hrs)

1. Principles of the Otto Cycle
   a. Engine cycles
      (1) Two stroke and four stroke cycle principles
      (2) Piston engine stroke
      (3) T.D.C. and B.D.C.
      (4) Sequence of events of the two stroke cycle and the four stroke cycle engines
   b. Engine events
      (1) Relation of valves to stroke
      (2) Relation of piston to crankshaft position
2. Cylinder Nomenclature and Materials
   a. Nomenclature of the cylinder
      (1) Cylinder head and barrel
      (2) Cooling fins
      (3) Flange and skirt
   b. Materials and attaching methods used in cylinder construction
      (1) Method of attaching cylinder head
      (2) Cylinder head construction materials
      (3) Cylinder barrel construction materials
      (4) Valve guide and seat construction materials
3. Identification of Crankshaft and Connecting Rod Assemblies
   a. Identification and function of crankshaft and rod assemblies
      (1) Purpose of crankshaft
      (2) Purpose of counterweight and dynamic dampner
      (3) Types of crankshaft assemblies
      (4) Types of connecting rods
      (5) Methods of securing connecting rods
      (6) Purpose of sludge tubes and plugs in crankshaft

I. RECIPROCATING ENGINES (Contd.)

(7) Precautions in handling crankshaft and rod assemblies

b. Methods used in construction of crankshaft assemblies
(1) Nitriting bearing surfaces
(2) Forging
(3) Chrome plating

4. Engine Classification
a. Cooling methods
(1) Advantages of air cooling over liquid cooling
(2) Effect of cooling on fits and clearances
(3) Effect of oil viscosity on cooling and wear
b. Cylinder arrangement
(1) Opposed
(2) Radial
(3) Inline

B. Overhaul Reciprocating Engines
(Level - 3) (EIT-105 hrs) (T-9 hrs) (L/S-96 hrs)
1. Propeller Reduction Systems
a. Propeller speed reduction
(1) Factors limiting the rotational speed of a propeller
(2) The relationship of power to RPM
(3) Affect of propeller diameter on propeller RPM
b. Types of gear reduction
(1) Advantages of spur gear system
(2) Advantages of bevel planetary gear system
(3) The planetary gear system versus the reverse planetary gear system
(4) FAA regulations regarding propeller reduction systems
(5) Engine factors influencing the type of gear reduction
2. Identification and Function of the Nose and Power Case
a. Power case loads
(1) Forces acting on the power case
(2) Methods of attaching to power case
(3) Reasons why sealing compounds are not normally used on power case

I. RECIPROCATING ENGINES (Contd.)

b. Nose case loads
   (1) The way in which thrust loads are transmitted to the nose case
   (2) Engine gyroscopic forces
   (3) Absorbing of torque loads in engine nose cases
   (4) Transmission of radial loads in nose case to power case
c. Construction features
   (1) The methods of retaining thrust bearings in the nose case
   (2) Design features that identify propeller reduction system

3. Valve Springs and Their Function
   a. Purpose of multi-springs
      (1) Safety factor in the use of multi-springs
      (2) Define valve spring "float and bounce"
      (3) Define reasons for opposite winding of inner and outer spring coils
      (4) Define frequency cancelling effect of multi-spring assemblies
      (5) Reasons for using washer seats on multi-spring installations
   b. Checking of valve springs
      (1) Tools and procedures for checking spring tension
      (2) Tools and procedures for checking spring compression

4. Identifying Factors Affecting Volumetric Efficiency
   a. Affect of intake manifold on volumetric efficiency
   b. Explain the term "normal aspirating engine"
   c. Affects of supercharging on volumetric efficiency
   d. Affects of intake manifold leak on volumetric efficiency
   e. Affects of compression ratio on volumetric efficiency
   f. Relationship of RPM and volumetric efficiency
   g. Affect of valve timing on volumetric efficiency
   h. Relationship of throttle position to volumetric efficiency
   i. Relationship of propeller loading to volumetric efficiency

I. RECIPROCATING ENGINES (Contd.)

5. Valve Timing and Overlap
   a. Valve timing
      (1) Define: "B.D.C., T.D.C., A.B.C., and C.B.C.".
      (2) Reasons for timing
      (3) Valve "Lead and Lag"
      (4) Hot clearance
      (5) Cold clearance
      (6) Valve overlap
   b. Valve train nomenclature
      (1) Cam ring of camplate
      (2) Cam shafts
      (3) Cam lobe
      (4) Cam follower
      (5) Cam ramp and its purpose
      (6) "Zero lash" valve lifter
      (7) Rocker arms
6. Bearing Identification, Cleaning and Inspection
   a. Types of bearings
      (1) Type of bearings used with thrust loads
      (2) Type of bearings used with radial loads
      (3) Type of bearings used at high R.P.M.
   b. Lubrication
      (1) Plain type of bearings
      (2) Roller bearings
   c. Storage and handling
      (1) Prepare a new sealed ball bearing for installation
      (2) Prepare serviceable bearings for storage
      (3) Cleaning before inspection
7. Firing Orders of Reciprocating Aircraft Engines
   a. Radial engines
      (1) Single row
      (2) Twin row
   b. Opposed engines
      (1) Number one cylinder location variations by manufacturer
      (2) Different firing orders
   c. Inline engines
      (1) Features of an inline firing order
      (2) Determining the firing order of an engine without a data plate or manual

I. RECIPROCATING ENGINES (Contd.)

8. Accessory Drive Rotation, Speed and Location
   a. Accessory drive location
      (1) Nose case
      (2) Rear case
   b. Direct drive
      (1) Direction of spur gear in relation to pinion gear
      (2) The direction of the pinion gears involved in a planetary system
   c. Speed of rotation
      (1) The affect of size in gears in the spur and pinion system
      (2) The means in which the ratio is obtained in the planetary system
9. Problems in High Power Operation
   a. Operation limits
   b. Lubrication
   c. Temperature

II. QUINMESTER POST TEST

BEHAVIORAL OBJECTIVES

BLOCK I - RECIPROCATING ENGINES

A. Reciprocating Engine Theory

1. Principles of the Otto Cycle

Given:

An unlabeled sketch or diagram illustrating the five events and four strokes of an Otto cycle.

Performance:

The student will label the illustrations and describe the five events which occur in an Otto cycle.

Standard:

The labeled sketches or diagrams will correctly identify the piston, valve, and crankshaft positions in each of the four strokes. Correct nomenclature will be used in labeling the diagrams and describing the events.

2. Cylinder Nomenclature and Materials

Given:

A typical air cooled cylinder, an unlabeled diagram or sketch of that cylinder, and appropriate reference material.

Performance:

The student will interpret information from the manual, identify the construction features of the cylinder and label the diagram or sketch.

Standard:

The student will identify as a minimum requirement, the following parts of a cylinder: head, skirt, fins, sparkplug bushing, base flange, rocker cover, valve guide and seat, valve ports. Correct nomenclature will be used when labeling the diagram or sketch.

3. Identification of Crankshaft and Rod Assemblies and Their Functions

Given:

A display of various crankshaft and rod assemblies and associated reference manuals.

Performance:

The student will examine the crankshaft and rod assemblies and identify an assembly from an engine that incorporates a dynamic dampener. He will explain the purpose of a dynamic dampener. The student will identify, disassemble and reassemble an articulating rod in a master rod assembly, naming and describing the function and the principal parts of the crankshaft assembly.

Standard:

The student will correctly distinguish between the various types of crankshaft and rod assemblies. He will follow the correct procedure while disassembling and reassembling the articulating rod and will accomplish the assignment without damage to the tools or the part. Correct nomenclature will be used during all explanations.

4. Engine Classification

Given:

A random display of air or liquid cooled engines of the radial, opposed and inline type.

Performance:

The student will physically examine the engines and classify them by both cylinder arrangement and method of cooling.

Standard:

Identification will be without error.

B. Overhaul Reciprocating Engines

1. Propeller Reduction Systems

Given:

A drawing or sketch of both a spur and a planetary propeller reduction gearing system, including BMEP system, and a display or cutaway of one of the two systems.

Performance:

The student will label the components illustrated in the drawings. He will indicate by means of arrows the direction of rotation of each of the gears in the reduction system and describe three reasons for reducing propeller speeds. He will trace and explain the operation of the BMEP system.

Standard:

Correct nomenclature will be used in labeling the drawings and describing the systems.

2. Identification and Function of the Nose and Power Case

Given:

Mock-ups, cutaways or actual nose and power cases of reciprocating engines.

Performance:

The student will recognize the construction features and describe how the work loads are imposed on the nose and power cases.

Standard:

The student will use correct nomenclature to identify the features and describe the loads and forces.

3. Valve Springs and Their Function

Given:

A random display of poppet valve spring assemblies from typical aircraft piston engines.

Performance:

The student will recognize and identify a multi-spring assembly from the valve spring display and describe the reason for the use of multi-spring assemblies in aircraft engines.

Standard:

Recognition and identification of the assembly will be without error. The student will cite at least two reasons for the use of multi-spring assemblies.

4. Identifying Factors Affecting Volumetric Efficiency

Given:

Information sheets, reference manuals and a listing of at least seven factors that affect the volumetric efficiency of an engine.

Performance:

The student will explain how five of the factors are related to volumetric efficiency.

Standard:

Correct nomenclature will be used with at least five factors of the explanation.

5. Valve Timing and Overlap

Given:

A valve timing diagram and a blank table of limits and chart with manufacturer's instructions for an engine that incorporates external valve timing adjustments.

Performance:

The student will describe and explain valve timing procedures and explain reasons for valve overlap. He will complete the valve timing and fill in the table of limits.

Standard:

The student will use correct nomenclature as a part of the description and explanation. Valve timing diagram and completed table of limits will be within the tolerances prescribed in the manufacturer's manual.

6. Bearing Identification, Cleaning and Inspection

Given:

A random display of plain, roller, ball and needle bearings of the type found in aircraft engines and the manufacturer's manuals specifying the inspection procedures and limits applicable to these bearings.

Performance:

From this display of bearings, the student will name and identify each type of bearing and describe one location where such a bearing would be used within the engine. He will clean, inspect each type of bearing and judge whether the bearing is of return-to-service quality.

Standard:

Identification of each type of bearing will be without error. Interpretation of the tolerances and inspection procedures specified in the manuals and the acceptance or rejection of the bearings will be without error.

7. Firing Orders of Reciprocating Aircraft Engines

Given:

Aircraft engines of the radial, opposed and inline types and manufacturer's manuals.

Performance:

The student will explain the principles that determine the firing order of each engine. Using the information available in the manuals and on the engine data plate, the student will rotate the crankshaft, observe the valve rocker arm action and point to each cylinder in the order in which it will fire.

Standard:

The explanation and determination of the firing order will be without error.

8. Accessory Drive Rotation, Speed and Location

Given:

An aircraft engine incorporating at least five accessory drives, a line drawing of the accessory case of the engine and the associated manufacturer's manual.

Performance:

The student will interpret information from the manual, rotate the crankshaft of the engine, then draw arrows on the diagram illustrating the direction of rotation and the speed of the accessory drive gears.

Standard:

The interpretation of information will be without error.

9. Problems in High Power Operation

Given:

A written list describing twenty problems that are common to the operation of aircraft engines and the operation limitations of a specific engine.

Performance:

Provided with a list describing problems common to the operation of aircraft engines, the student will identify five problems which could have resulted from high power operation before the oil temperature and pressures reached operating limits.

Standard:

At least four of the five problems identified by the student will be correct.

BIBLIOGRAPHY
(Overhaul, Inspection and Repair of Reciprocating Engines I)

Basic References:

1. Cargino, Lawrence T. and Karvinen, Clifford H. Aerospace Propulsion Power Plants. 4th ed. St. Louis: Educational Publishers, Inc., 1967. Pp 677.

2. Northrop Institute of Technology. Powerplants for Aerospace Vehicles. 3rd ed. New York: McGraw-Hill Book Company, Inc., 1965. Pp 480.

Supplementary References:

3. Brim, Daniel J. and Bogess, H. Edward. Aircraft Engine Maintenance. 1st ed. New York: Pitman Publishing Corporation, 1940. Pp 470.

4. Northrop Aeronautical Institute. Aircraft Powerplants. 1st ed. New York: McGraw-Hill Book Company, Inc., 1965. Pp 392.

5. Northrop Institute of Technology. Basic Science for Aerospace Vehicles. 3rd ed. New York: McGraw-Hill Book Company, Inc., 1963. Pp 320.

6. U.S. Civil Aeronautics Administration. Aircraft Power Plant Handbook. Technical Manual 107. 1st ed. Washington D.C.: U.S. Government Printing Office, 1949. Pp 359.

7. U.S. Department of the Air Force. Power Plant Maintenance for Reciprocating Engines. AF Manual 52-12. 1st ed. Washington, D.C.: U.S. Government Printing Office, 1953. Pp 452.

8. U.S. Department of the Navy, Airplane Power Plants. U.S. Navy Manual NAWEPS 00-80T-42. 1st ed. Washington, D.C.: U.S. Government Printing Office. Pp 258.

Federal Aviation Publications:

1. Federal Aviation Administration. Acceptable Methods, Techniques, and Practices - Aircraft Inspection and Repair, Advisory Circular 43.13-1. Washington, D.C.: U.S. Government Printing Office, 1965. Pp 232.

2. Federal Aviation Administration. Acceptable Methods, Techniques, and Practices - Aircraft Alterations, Advisory Circular 43.13-2. Washington, D.C.: U.S. Government Printing Office, 1965. Pp 74.

3. Federal Aviation Administration. Aircraft Engine and Propeller Type Certification Data Sheets. Washington, D.C.: U.S. Government Printing Office, 1968.

4. Federal Aviation Administration. Aircraft Type Certificate Data Sheets and Specifications. Washington, D.C.: U.S. Government Printing Office, 1967.

5. Federal Aviation Administration. Airframe and Powerplant Mechanics Examination Guide, Advisory Circular 65-2A. Washington, D.C.: U.S. Government Printing Office, 1969. Pp 63.

6. Federal Aviation Administration. Federal Aviation Regulations Parts: 1, 23, 25, 27, 29, 33, 35, 37, 39, 43, 45, 47, 65, 91 and 145. Washington, D.C.: U.S. Government Printing Office, 1969.

7. Federal Aviation Administration. Summary of Supplemental Type Certificates. Washington, D.C.: U.S. Government Printing Office, 1965.

Films:

1. Aircraft Engines-Types, Mechanisms, and Oil Systems. 16mm. 20 min. Black and White. Sound. G.T.B. 5-3.

2. Cyclone Combustion. 16mm. 11 min. Black and White. Sound. C.T.B. 4-12

3. Energy and Work. 16mm. 11 min. Sound. EBEC.

4. Evolution of Power. 16mm. 11 min. Color. Sound. D. R. Douglas.

5. Gas Laws and Their Applications. 16mm. 16 min. Black and White. Sound. EBEC.

6. Harnessed Lightning. 16mm. 10 min. Color. Sound. Allison Division, General Motors.

7. Inspection and Reconditioning of Valve Assembly, 16mm. 20 min. Black and White. Sound. G.T.B. 3-21.

8. Laws of Gases, The. 16mm. 10 min. Black and White. Sound. EBEC.

9. Overhauling the Crankshaft Assembly. 16mm. 14 min. Black and White. Sound. G.T.B. 3-30.

10. Thompson Valves. 16mm. 30 min. Black and White. Sound. G.T.B. 5-2.

Filmstrips:

11. 2-Cycle Engine, A Unit of Instruction. 3M Company.

12. 4-Cycle Engine, A Unit of Instruction. 3M Company.

A P P E N D I X

Quinmester Post Test Sample

Quinmester Post Test

Name_____ Date_____ Score_____

Multiple Choice Test Items

Each question below is followed by four possible answers, select the best answer and mark your answer sheet accordingly.

1. During what stroke or strokes are both the intake and exhaust valves open?
    1. Compression.
    2. Intake.
    3. Exhaust and intake.
    4. Power and exhaust.

2. What is the main advantage of valve overlap in a reciprocating engine?
    1. It simplifies maintenance on the engine valves.
    2. It enables the engine to operate at a higher RPM.
    3. It increases volumetric efficiency.
    4. It prevents valve blow-by.

3. When does ignition occur in a four stroke cycle engine?
    1. After the piston begins its downward travel on the power stroke.
    2. Before the piston reaches top center on the compression stroke.
    3. At top center of the compression stroke.
    4. At the beginning of the power stroke.

4. Valve seats are installed in a cylinder by
    1. shrinking.
    2. sweating.
    3. welding.
    4. peening.

5. Which part of a cylinder has the greatest cooling gin area?
    1. Around the exhaust port.
    2. Where the cylinder and the head join together.
    3. In the valve cover area.
    4. Around the cylinder housing.

6. Which of the following statements is true concerning a crankshaft?
    1. Counterweights provide static balance.
    2. Counterweights are used to reduce torsional vibration.
    3. Dampeners reduce centrifugal loads.
    4. Dampeners provide static balance.

7. An eighteen cylinder double row radial engine with articulating rods has
    1. 9 articulating rods.
    2. 18 articulating rods.
    3. 1 master rod.
    4. 2 master rods.

8. The inside of a cylinder barrel is surface-hardened by
    1. age hardened.
    2. chromium plating.
    3. emac process.
    4. nitriding.

9. Crankshaft sludge tubes should be replaced
    1. at each 100 hour inspection.
    2. at each oil change.
    3. at each engine overhaul.
    4. when they are worn beyond limits

10. Crankshaft bearing surfaces are surface-hardened after grinding to undersize by
    1. chrome plating.
    2. heat treating.
    3. flame hardening.
    4. nitriding.

11. Most aircraft engines are classified according to their
    1. weight per horsepower.
    2. fuel consumption.
    3. total displacement.
    4. dry weight.

12. The main advantage of air cooled engines over liquid cooled engines is that
    1. air cooled engines have less weight per horsepower.
    2. liquid cooled engines have cooling system leaks.
    3. air cooled engines warm-up faster.
    4. liquid cooled engines freeze up in cold weather.

13. A propeller reduction gear system
    1. is incorporated to permit propeller tip speeds to slightly exceed the speed of sound.
    2. permits full engine power output with a relatively low RPM.
    3. permits full engine power output but keeps propeller tip speeds below the speed of sound.
    4. is utilized only during takeoff to insure full engine power and RPM but to keep propeller tip speeds below the speed of sound.

14. Which of the following is considered a minor repair by the FAA?
    1. Replacing the cylinders of a P&W R-985 engine.
    2. Overhaul of a GO-435 Lycoming engine.
    3. Disassembly of the crankshaft and measuring the main bearing on a P&W R-985 engine.
    4. Removing the supercharger impeller on an R-1830 engine.

15. Aircraft engine cylinders are mounted directly to the
    1. nose case.
    2. power case.
    3. blower case.
    4. accessory case.

16. Aircraft engine power and nose cases are usually manufactured
    1. from cast iron.
    2. from forged aluminum.
    3. from steel castings.
    4. from aluminum castings.

17. Most aircraft engine valve systems use
    1. single valve springs.
    2. double valve springs with coils wound in the same direction.
    3. double valve springs with coils wound in opposite directions.
    4. double valve springs without regard to direction of winding.

18. When inspecting valve springs, the correct procedure is to check
    1. the length of the springs.
    2. the diameter of the springs.
    3. the force required to stretch the springs.
    4. the force required to compress the springs.

19. What effect will increased exhaust back pressure have on the volumetric efficiency of an aircraft engine?
    1. Increase in volumetric efficiency at low altitudes.
    2. Decrease in volumetric efficiency at high altitudes.
    3. Increase in volumetric efficiency at all altitudes.
    4. Decrease in volumetric efficiency at all altitudes.

20. If hydraulic lifters have no clearance at normal engine operating temperature, this is
    1. caused by an improper setting at cold temperatures.
    2. caused by an improper setting at hot temperatures.
    3. caused by valve stretch.
    4. a normal condition.

21. When adjusting the valves on a radial engine with a floating cam ring, you should
    1. eliminate the cam float before setting the valve clearance.
    2. set the exhaust valves first.
    3. set the intake valves first.
    4. set the intake and exhaust valves in rotation around the engine.

22. What type of bearing is used for both thrust and radial loads?
    1. Ball bearing.
    2. Roller bearing.
    3. Friction bearing.
    4. All of the above.

23. Which of the following is the firing order of a 9 cylinder radial engine?
    1. 1 2 3 4 5 6 7 8 9
    2. 1 9 2 8 3 7 4 6 5
    3. 1 5 9 6 2 7 3 4 8
    4. 1 3 5 7 9 2 4 6 8

24. Aircraft engine firing orders may be found
    1. on the engine data plate.
    2. in the Aircraft Engine Type Certificate Date Sheet.
    3. by tracing the ignition leads from the magnetos, starting with Number 1.
    4. all of the above.

25. When operating an aircraft engine at high power settings for extended periods of time
    1. the engine should be inspected more frequently.
    2. the oil tank should be filled with 10 percent more oil.
    3. the next higher fuel grade should be used.
    4. the engine should be overhauled at one half (½) of its normal time limit.

KEY TO QUINMESTER POST TEST
9055.01

1. 3	9. 3	17. 3
2. 3	10. 4	18. 4
3. 2	11. 3	19. 4
4. 1	12. 1	20. 4
5. 1	13. 3	21. 1
6. 3	14. 1	22. 4
7. 4	15. 2	23. 4
8. 4	16. 4	24. 4
		25. 1